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ABSTRACT

The use of an index to match classes and classroom space was assessed. The index initiates the use of several variables controlling utilization: number of hours that rooms are scheduled per week, average percentage of occupancy per room, and amount of area per station per room. Interviews with deans covered current classroom assignment procedures/practices and the schools' space requirements. Satisfactory and good classroom usage were defined. Tables were prepared, and are appended, that compare each unit's number of classrooms, the size (number of square feet and number of stations), to majors (headcount) or hours (credit and contact) produced. Different patterns of classroom assignment were found in different units, most based on historical patterns. These space allocation patterns did not necessarily reflect the current situation based on student enrollments, credit, and/or contact hour production. Outcomes of the assessment included the designation of a person to oversee the development of an automated centralized classroom scheduling system. An interim modification was that the provost's office would assign classroom space. (SW)

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CLASSROOM UTILIZATION

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for Management Research, Policy Analysis, and Planning

This paper was presented at the Twenty-Sixth Annual Forum of the Association for Institutional Research held at the Marriott Orlando World Center, Orlando, Florida, June 22-25, 1986. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum Papers.

Ann K. Dickey, Chair
Forum Publications Editorial
Advisory Committee

ABSTRACT

This study sought to assess matching of classes and classroom space with the use of an index developed and employed by campus planners and state/system facility officers. The index was presented in this study to cause academic administrators to review facility use in terms other than traditional variables (users per facility unit) and in order to initiate use of variables including area, number of stations, percentage of occupancy, and hours of use per week. The patterns of space allocation by schools generally reflected historical growth which would not necessarily reflect the current situation based on student enrollments, credit and/or contact hour production.

BACKGROUND

Space utilization studies were an influence in the early years (1958-67) of Institutional Research, (Fincher, 1985) and have returned in the context of life cycle planning for campus and system decision makers in the form of integrated models for establishing future needs (Wood and Finger, 1986). The Carnegie Commission on Higher Education (1972) concluded space utilization studies were an indispensable aspect of higher education planning and warned against attempts to establish these analyses as a simple matter. "Providing adequate physical plant facilities is one of the greatest problems of higher education today--a problem that can never be definitely and finally solved because education is not a static process" (Middlebrook, 1958). Therefore, the conceptual framework for this analysis comes from Halstead's (1974) introductory overview on "Space Management and Projection" by defining the problem of space utilization studies to include "systematic planning of new facilities and controlled utilization of existing space."

As in all studies of institutional activities, certain guidelines and operational definitions had to be established. Much of the early methodology to study utilization came in Smith's (1954) study "College and University Space Requirements" (Dahnke and others, 1971). Many systems of

higher education became involved in facility monitoring and analyses following the comprehensive collection of data in the early stages of institutional research and the Higher Education Facilities Act of 1963.

At this point, state government, higher education systems, the federal government and anyone else who got involved in funding education was likely to get involved with facility data review. The descriptive data was there to be reviewed and systems were under way to establish criteria to evaluate utilization. The Western Interstate Commission for Higher Education (WICHE) and the American Association of Collegiate Registrars and Admission Officers (AACRAO) took the leadership for intra- and inter-institutional studies with the publication of the seven-volume handbook, The Higher Education Facilities Planning And Management Manuals (1971).

Until Blakesley's model utilization study appeared (Blakesley et al., 1968) most analysis was limited to traditional views of space which focuses on capital costs and raw usage data. After this Indiana investigation of space, utilization of non-residential area was accepted to be a multi-variable utilization test. The relationships between hours rooms are scheduled per week, average percentage of occupancy per room, and the amount of area per station were viewed as variables that could be used to define utilization.

OVERVIEW

In order to evaluate the question of classroom utilization and efficiency of class scheduling procedures, this study was initiated to evaluate major variables controlling utilization:

* Number of hours rooms are scheduled per week
* Average percentage of occupancy per room
* Amount of area per station per room

The standards for these variables were established in Indiana Facilities Utilization Survey For Colleges And Universities (Blakesley et al, 1967) and are presented later in this paper. The results of this study were limited to classrooms in use defined as lecture classrooms ("110") by a coding system developed by WICHE. This system is employed on most campuses as a part of a facility inventory. These "110" classrooms are designated for classroom lecture instruction by definition. Later studies included Class Labs "210", Special Class Labs "220", Non-Classroom Labs "250", and Conference Rooms "350". Further investigation was important to establish a comprehensive evaluation because it was noted that traditional "110"/lecture classroom activity was being conducted in each of the areas listed above.

UTILIZATION INDEX

As reported earlier, utilization efficiency was measured as a function of classroom area, number of stations, total room enrollments and hours of use. The lower the utilization index (UI), the more efficient utilization.

$$\text{UTILIZATION INDEX} = \frac{\text{(ROOM AREA/STATIONS)}}{\text{(ROOM HOURS OF USE PER WEEK) X (ROOM MEAN OCCUPANCY)}}$$

An hour was defined as 50 minutes of classroom instruction. Therefore, if a room with 684 sq. ft. and 54 stations was scheduled for 13 classes that met for 35 hours per week and the mean occupancy is 36%--the UI would be satisfactory (1.00).

The UI was first used to measure facility usage at Purdue and has since been used by institutions and state-wide systems to examine future classroom needs. This study employed the index to evaluate different methods of classroom assignment and scheduling procedures/practices. For a detailed explanation of the Purdue University student-scheduling system Halstead (1974) suggested a review of Abell and Mortan, 1965a; Abell et al, 1965b; and Marshall and Morgan, 1969.

In keeping with research completed on other campuses, GOOD usage for a large public institution (such as North Carolina State) would be below .8 to .7. For this study, SATISFACTORY usage was defined as below 1.0. Satisfactory usage can be accomplished by scheduling room usage for 30 to 36 hours per week, by increasing station-occupancy percentage to 50-66% and/or by increasing the stations per room.

Interviews were conducted in each dean's office and a time was scheduled to review current classroom assignment procedures/practices. During these interviews, the schools' space requirements were discussed and preliminary classroom data were presented. Many comments were received from those who participated in this study. A summary of these comments were presented in the report as representative of the teaching community's point of view.

At that time, all classroom scheduling was controlled by units within or under the control of the deans office, and data was reported to each academic school dean. The reports represented the number of classrooms below a .7 as GOOD usage and below 1.0 as SATISFACTORY usage. In addition, intra-institutional and "benchmark" data was provided to the dean for their review (examples in Appendix A).

OBSERVATIONS

1. This investigation raised awareness with the schools (scheduling units) of their strengths and weaknesses in regard to classroom scheduling use.

2. Units began to investigate ways to look for optimum use of space.

3. Class size was often determined by the classroom assigned and not the ability/desire of the faculty member or the nature of class.

4. Scheduling and class offerings are somewhat established based on tradition and learned developmental needs. Changes in enrollment pattern and population over the years often have not been reflected in scheduling changes. Units with declining enrollment have not always adjusted their resources (particularly space) to reflect needs. Therefore, multiple course sections of low enrollment (below 50%) occur.

5. Many units where labs/studio are important components of their studies have continued the concept of scheduling classes in the morning and labs/studios in the afternoon. Since these activities often occur in different rooms, additional space could be freed up with some modification of this scheduling pattern.

6. Classroom space is often needed for non-scheduled academic/professional related activity, i.e., oral examination, paper presentation, faculty seminars. This is not reflected in scheduled activity.

7. Faculty believe that their instruction is improved with the use of models, samples, and other visual aids. Therefore, teaching within one's area is desirable. If teaching outside of one's area, a better system is needed for providing appropriate instructional aids and to assure an acceptable quality instructional environment.

8. Faculty express that the quality of teaching is impeded when scheduling too many classes back to back. Maintenance schedules also must be planned if classes are scheduled back to back.

9. Changing of class times must be sensitive to the units mission and need to coordinate class offering outside of the unit

10. Units without required courses (i.e., Humanities) must schedule courses at attractive times to fill sections.

11. Many units endorse a practice of offering required courses at non-prime time and electives during attractive hours. This generally improves overall percentages of enrollment.

12. A scheduling system relies on many dedicated professionals within the units and the support of Registration and Records to make the system work. These individuals work hard to meet the needs of <u>their</u> units.

RESULTS

Tables were presented in an attempt to review classroom utilization, allocation of space, and class scheduling. This was not an attempt to reduce complex issues to simple data or table presentations. Anyone who became involved with this study certainly sensed the dynamics of territory and its importance not reflected in any tabulation. Table 1 (as shown in Appendix A) presented the reviewer an opportunity to compare each unit's number of classrooms, the size (number of square feet and number of stations) to majors (headcount) or hours (credit and contact) produced. Additional tables represented the "by school" summary of classrooms scheduled. The targets of 30 to 36 hours of classroom use, 50 to 66% occupancy, 18 to 12 sq. ft. per station and an index of .7 to 1.0 were presented with a range.

When using the identified utilization variables, Physical and Mathematical Sciences (PAMS) (note: school with a large service role and many newer/developing course offerings] had the greatest percentage (93%) of classrooms scheduled at what was considered a satisfactory level or better of use (1.0 or below) to Design [note: school with traditional role and a large commitment to studio/practical experience] with the lowest percentage (0%).

STUDY RECOMMENDATIONS

The classroom scheduling system was evaluated to be marginally successful because of the sincere efforts of the employees who supported the system. In fact, the system did schedule 4400+ classes into 278 classrooms. Different practices of classroom assignment were found in different units--most were based on historical patterns. Each scheduling unit depends on its ability to predict existing resources--number of

students, faculty members' time, and available space. Success of units varies and reflects the amount of control over resources. Central (multi-units) control of classroom assignment and management produced greater efficiency. It was recommended that lasting change would best be achieved in a deliberate fashion and all changes should be made towards institutional centralized automated classroom scheduling system. These interim steps were suggested as modifications to help the existing system and to assist in future system development.

1. It was suggested that a reward/punishment system be associated with the scheduling system. With the use of the data collected for this study and the utilization index, it is recommended that classroom space be reassigned by the Provost office (as the chief academic officer). This redistribution would be designed to help those doing a good job in scheduling and force others to take steps to manage their resources.

2. It was suggested that Registration and Records be made responsible to develop an automated system where all available space be open for central assignment consideration. Once this was successfully accomplished, it could be a forerunner to a fully automated system.

3. It was suggested that Registration and Records continue to maintain the Facility Inventory file, the responsibility for its accuracy be designated to those existing personnel currently responsible for this file.

4. Finally, it was suggested that the quality variables for each classroom be examined with faculty members to assure minimum standards. There are currently significant differences in classroom quality.

OUTCOMES

A person was designated to oversee the development of an automated centralized classroom scheduling system. In order to accomplish this within one year a task force was appointed to offer direction. The task force included representatives of the teaching community, Registration and Records, and the institution's Administrative Computing Services (ACS). The following activity have occurred towards this goal:

1. A campus (with similar enrollments and course offerings) was visited by campus representatives.

2. An agreement was worked out "that all space is University space" and could be scheduled by other units. With the acknowledgment that historical boundaries do exist and therefore units will first be assigned space within the historical space . . ., next within their unit's school (and geographical area) . . ., and finally anywhere within the University with priority given to proximity to departmental offices, configuration of classroom, enrollment.

3. The facility inventory was audited in order to provide factual data to academic administrators.

4. Classroom quality issues were addressed, through the deans offices, and nearly one million dollars were appropriated for classroom improvements. A survey of teaching faculty members has been completed and a second set of quality recommendations are being developed.

5. Two "screens" were developed by ACS for our campus INTERACT system. This will allow any unit to review usage by location or by hours.

6. An automated software system with a powerful algorithm was purchased and data has been collected by course and room to define needs for an automated system.

CONCLUSION

It must be remembered that classroom space represents, on the average, only 9 to 17% (Halstead, 1974) (Carnegie Commission, 1972) of the assignable non-residential space. Even though classroom space appears to be a small portion of the campus, it is the area that is most subject to investigation by outsiders. Classroom space is generally viewed as the area best managed, since the academic process is perceived as the main mission of education by many.

Even though space management and utilization studies are problems which will never be totally resolved because of the dynamic nature of higher education--it is important that complete understanding of space as a limited resource be established. Anyone who works with campus space will need to be a negotiator, researcher, policy analyst, planner, and administrator. The absolute value of allocated space and how mismanagement; or often lack of management, costs the institution important dollars.

Space is not the most valuable resource in the instructional process. No study of space can be limited to simple variables of capital cost and raw usage data. Space management and therefore the study of space usage must be sensitive to the relationship of other resources--personnel, time, students, environment, etc.--in any study associated with space utilization.

Penn State reported in the Engineering News Record a 25% reduction of classroom space needed with a centralized classroom assignment system. The concept of space being carved up on political lines was reported by LSU in MIS Week (Jones, 1982) as a restriction to new academic program development. Just think of the Penn State example with a quarter of classrooms being closed down or reallocated to University units for other use. A quarter of the campus classrooms often represents the cost of a new classroom building. Or the LSU example where new programs could not be initiated because of a lack of space caused by political barriers. As new construction dollars for higher education becomes tighter, if not impossible to find, and the need for responsive academic programs in order to meet today's need become a firm reality, think of the existing allocated dollars that could be used (not to mention the hypothetical question asked by campus planners as to how many instruction dollars could have been saved in classroom construction if these concepts were initiated earlier).

Campus personnel associated with academic programs, classroom scheduling, campus planning, registration, space management and institutional researchers must be assured of and agree upon

1) Integrity of Data
   --use of existing facility computer files (or establishing appropriate files of room characteristics)
   --quality of data

2) Defining adequate classroom allocations
   --how to set standards for space

3) Examine the dynamic of space allocation
   --how to get academic administrators to expand their thinking beyond traditional measurements

4) Developing ways to evaluate space utilization
   --into the realm of . . .

Higher Education planners are now at that point with the aid of desktop microcomputers to develop comprehensive models to address the complex relationships between many variables. No longer can these tasks be assigned to those who use primitive information management techniques where card files and notebooks support an intuitive priority scheme of classroom assignment applied in determining what classes should be assigned first. An optimum system must go beyond class assignments and be able to examine the range of resources available.

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APPENDIX A

Table 1
FALL 1984
ALLOCATIONS BY SCHOOL
WITH % OF TOTAL*

	Number of Classrooms	Area	Stations	A/S	Majors Head CT	Hours: Credit	Hours: Contact
Ag. and Life Sci.	28	27,059	1,918	14.1	3,433	25,717	34,585
	11.3%	13.8%	14.7%		17.3%	9.6%	10.5%
DN	8	5,355	346	15.4	601	6,634	11,710
	3.2%	2.7%	2.6%		3.0%	2.%	3.6%
ED	19	13,238	686	19.3	1,188	16,496	21,129
	7.7%	6.7%	5.2%		6.0%	6.2%	6.4%
ENG	46	44,856	2,525	17.7	6,104	38,581	47,842
	18.5%	22.9%	19.2%		30.7%	14.5%	14.6%
FR	6	4,934	303	16.3	762	3,521	5,402
	2.4%	2.5%	2.3%		3.8%	1.3%	1.6%
HASS	86	52,258	3,193	16.4	4,282	92,632	101,873
	34.7%	26.6%	24.3%		21.5%	34.7%	31.0%
PAMS	45	39,121	3,228	12.1	2,475	78,236	99,582
	18.2%	19.9%	24.4%		12.5%	29.3%	30.3%
TX	10	9,623	968	9.9	1,041	5,033	6,625
	4.0%	4.9%	7.3%		5.2%	1.9%	2.0%
TOTALS*	248	196,444	13,168	14.9	19,886	266,850	328,748
Student Affairs	13	10,720	834	12.6			
University Studies	5	1,959	157	12.5			
Vet Medicine	9	8,510	516	16.5			
CAMPUS TOTALS	275	217,633	14,675	14.8	20,125	271,475	333,408

* Excluding Vet Medicine, Student Affairs, and University Studies

Classrooms = are those rooms coded by Academic units for classes ("110").

Area = total amount of square feet for classrooms

Stations = total number of student work area (seats) for classrooms

A/S = Area per station - average amount of square feet per station for all classrooms

APPENDIX A (continued)

Table 2
Utilization Rank Order by School
Based on Fall 1984 Schedule

SCHOOL	NO. OF CLASSROOMS	CLASSROOM USAGE (% BELOW 1.0 UI) (Satisfactory)	CLASSROOM USAGE (% BELOW .7 UI) (Good)
Physical and Mathematical Sciences	44	93%	86%
Humanities and Social Sciences	79	73%	52%
Education	19	69%	37%
Engineering	45	45%	20%
Textiles	9	45%	0%
Forest Resources	6	33%	17%
Agriculture and Life Sciences	27	30%	15%
Design	8	0%	0%
TOTAL	237	61%	42%

Table 3
"110" Classrooms not in Use
Fall 1984

ROOM	BUILDING	CONTROL	STATIONS	SQ. FT.
2548	Gardner Hall	GN	32	966
424	Daniels Hall	EE	19	506
236	Erdahl-Cloyd	SP	25	377
312	Hillsborough	EB	27	345
B3H	1911 Building	FL	10	415
109	Tompkins Hall	Eng	10	613
G121	Tompkins Hall	HSS	30	576
359	Harrelson	MA	10	309
120	Clark Lab	TC	20	307
130	Bagwell	RH	30	408
129	Reynolds Co.	AIR	40	675
TOTAL			253	5,497

SAMPLE

APPENDIX A (continued)

Table 4
Based on Fall 1984 Class Schedule
SUMMARY INFORMATION

Ag. & Life Sciences	27	Classroom - Code "110"
Room Use		(range (2) 3 to 48.6 hrs./week)
below 30 hrs./week	17	
below 36 hrs./week	22	
Station-occupancy percentage		(range 12 to 85%)
below 50%	16	
below 66%	25	
Station Area		(range (2) 9.4 to 39.4 ASF)
above 18 assigned sq. ft./station	8	
above 12 assigned sq. ft./station	20	
UI		(range .43 to 23.5)
above 1.0	19	
above .7	23	

BUILDINGS:	BOS	DSW	GA	KI	PK	SC	SFS	WMS
ROOMS:	2722	143	2207	103	5	131	103	2104
	3712	123B	2211	125	5A		105	2112
	4704	144	2213	159	110		114	2215
		158	3214					2312
		142	3516					

CONTROL:	ALS	AWS	BAE	BS	CS	ENT
	FS	GN	HS	PO	PP	SSC

AREA IN USE: 26,093 sq. ft.

STATIONS IN USE: 1,886

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110 Classrooms not scheduled for Fall 1984: 1 room: 32 stations and 966 sq. ft.: 2548 Gardner Hall (GN)